Mean, Line Plots, Stem and Leaf Plot Spreadsheet

Mathematics

6.10 The student uses statistical representations to analyze data. The student is expected to:

- (A) select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot.
- (B) identify mean (using concrete objects and pictorial models), median, mode, and range of a set of data
- (D) solve problems by collecting, organizing, displaying, and interpreting data.

Technology Applications

The student demonstrates knowledge and appropriate use of hardware components, software programs, and their connections. The student is expected to:

- (1)(a) demonstrate knowledge and appropriate use of operating systems, software applications, and communicate and networking components.
- (1)(c) demonstrate the ability to select and use software for a defined task according to quality, appropriateness, effectiveness, and efficiency.
- (1)(f) perform basic software application function including, but not limited to, opening an application program and creating, modifying, printing, and saving documents.

The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

- (7)(b) plan, create, and edit spreadsheet documents using all data types, formulas and functions, and chart information.

Materials

Advanced Preparation:

- Students should have access to computers with a spreadsheet program and/or a projection device to use a spreadsheet as a class demonstration. Load the **Seven Friends spreadsheet** on each computer.
- Transparencies: **Chocolate Candy**, **Class Data**
- Piece of paper labeled **"Median"** in large print.
- In large print, label one piece of paper with the number **32**.
- In large print, label seven pieces of paper with the following numbers (one number per paper):**18, 24, 24, 24, 32, 36, 38**
- Prepare 4 zipper bags for each student group – fill each as indicated. Bag A: 25 centimeter cubes; Bag B: 28 centimeter cubes, Bag C: 42 centimeter cubes, and Bag D: 9 centimeter cubes.

For each student:

- **Seven Friends** activity sheet
- **How Far Can We Stretch?** activity sheet
- **What is Missing?** activity sheet
- **Class Data** recording sheet

For each student group of 3 - 4 students:

- Chart paper
- Markers
- Prepared zipper bags with cubes
- Measuring tapes with customary measurements

ENGAGE

The Engage portion of the lesson is designed to create student interest in the development and understanding of mean. This part of the lesson is designed for groups of three to four students.

1. Distribute a set of 4 bags to each group and place **Chocolate Candy Transparency** on the overhead. If a group has only 3 participants, have them pretend they have a fourth participant for this activity.
2. Give student groups time to work the problem and then write their answers and solution strategy on a piece of chart paper. Have groups hang their chart paper on the wall.
3. When all groups are finished, one person from each group should stay with their chart paper to answer questions others may have during a Gallery Tour. Allow about 5 minutes for a Gallery Tour. Students should be looking for similarities and differences in the group's strategies.

Note: The teacher is looking for at least two different solution strategies. One of the strategies should be to combine all of the colored chocolate candies and divide them up evenly into four groups. The other important strategy is to take some of the colored chocolate candies from the person with the most and give them to the person with the least in an attempt to balance or even out the pairs.

Facilitation Questions

- How many colored chocolate candies should each person have once the candy is distributed evenly? *26*
- Did each group find the number of colored chocolate candies each friend should have using the same strategy? *Answers may vary.*
- What are the similarities in the strategies? What are the differences in the strategies? *Answers may vary.*
- Did any group give an example of when their strategies may not work? If so, what were they? *If the data would not divide evenly into the given number of groups, they may encounter some difficulty. However, students could decide the approximate number of candies that would be in each bag.*
- Suppose the four bags had the following numbers of candies: 142, 158, 212, and 356. What strategy could be used to find how many candies each bag would have if the candies were redistributed evenly? Why would you choose this strategy? *Since you are working with much larger numbers, it would not be as efficient to model redistributing that many candies. The most efficient method would be to add to find the total number of candies (868), and then divide into 4 groups (217).*

EXPLORE

The Explore portion of the lesson provides the student with an opportunity to be actively involved in the exploration of the mathematical concepts addressed. This part of the lesson is designed for groups of three to four students. Ideally, there should be one computer for each pair of students.

1. Distribute the **Seven Friends** activity sheet to each student. Students should work with their group members to complete steps 1 to 7 of this activity. For step 7, students will need access to the **Seven Friends Spreadsheet Sheet 1**. The teacher should be actively monitoring the groups, redirecting and providing assistance where necessary.

2. After students have successfully completed steps 1 to 7, direct them to open **Seven Friends Spreadsheet Sheet 2** on their computers. In groups, students will analyze their data and graphs to discover how stem and leaf plots and line plots are created.

EXPLAIN

The Explain portion of the lesson is directed by the teacher to allow the students to formalize their understanding of the TEKS addressed in the lesson. Debrief the activity as directed below.

1. Debrief the concept of mode by asking the following questions.

Facilitation Questions

- What was the most common number of candies in a bag? *24*
- How would the answer change if two more bags were added, each containing 32 candies? *There would be 2 modes : 24 and 32*
- What if each bag of candy contained a different number of candies? *There would be no mode, since no number occurs any more often than any other number.*

2. Debrief the concept of median by asking 7 volunteers to come to the front of the room. Hand each volunteer one of the numbered cards (18, 24, 24, 24, 32, 36, 38).

Facilitation Questions

- Ask the class to explain a strategy that could be used in order to find the median. *The students should line up from least to greatest. Remove one student from each end. The student left in the middle represents the median.*

3. Using a strategy suggested by the class, find the student who represents the median value. Have that student hold the "Median" sign so that all students can see it. Ask the 7 volunteers to line up again from least to greatest.

Facilitation Questions

- What do you notice about the values of the numbers on the papers to the median's left? *The values are equal to or smaller than the median's value.*
- What do you notice about the values of the numbers on the papers to the median's right? *The values are larger than or equal to the median's value.*
- How many people are standing to the left of the median? *3*
- How many people are standing to the right of the median? *3*

4. Ask for one more volunteer to join the other students at the front of the room. Hand that student the additional card labeled "32". Ask the students to line up again from least to greatest.

Facilitation Questions

- What happens this time when they try to find the median? *There are 2 students left in the middle.*
- What value would represent the number of candies that would be halfway between the two students? *The value that falls exactly halfway between 24 and 32. (28)*
- How many values fall to the left of 28? *4*
- How many values fall to the right of 28? *4*
- What do you notice about the number of values that are to the left and the right of the median? *They are equal.*

5. Have the students return to their seats.

6. Debrief the concept of range using the following questions.

Facilitation Questions

- Using the original set of data, what was the difference between the number of candies in the largest bag and the smallest bag? *20*
- What if the smallest number of candies remained at 18, but the set of data had a range of 25 instead of 20? What does that imply about the data set? *The largest number of candies would have been 43 (25+18).*

7. Debrief the concept of mean using the questions below.

Facilitation Questions

- If the candies were redistributed so each person had the same amount, how many would each person have? *28*
- What strategy did you use to find this value? *Answers may vary.*
- What if the mean for the 7 friends was 25? Would the total number of candies be more or less than the previous total? Why? *The total number of candies would be less than the previous total. If 7 friends each had 25 candies, the total number of candies would be 175 instead of 196.*

8. To debrief the concept of stem and leaf plots, ask participants to share their thoughts on how the computer created the stem and leaf plot.

Facilitation Questions

- How are stem and leaf plots created? *Answers may vary.*
- The values to the left of the vertical line are called the stems. What values were used to make the stems? *1, 2, and 3*
- Where did these values come from? *They represented the tens places of the number of candies in a bag.*
- The values to the right of the vertical line are called leaves. Where did these values come from? *They represented the ones places of the number of candies in each bag.*
- What type of information does a stem and leaf plot provide? *It shows each number in least to greatest order.*
- Can you identify the mode from the stem and leaf plot? *Yes, it is easy to see that 24 occurs more often than any of the other values.*
- Can you identify the minimum value from the stem and leaf plot? If so, what is it and where is it located? *Yes, the minimum value is 18. It is the first "leaf" and its corresponding stem.*
- Can you identify the maximum value from the stem and leaf plot? If so, what is it and where is it located? *Yes, the maximum value is 38. It is the last "leaf" and its corresponding stem.*
- Can you identify the median from the stem and leaf plot? If so, how? *You could mark off a leaf from the top and bottom until there is exactly one value left in the middle. This value represents the median.*
- Can you identify the mean from the stem and leaf plot? *No, but you could do calculations to find the value of the mean.*

9. To debrief the concept of line plots, ask participants to share their thoughts on how the computer created the line plot.

Facilitation Questions

- How are line plots created? *Answers may vary.*
- Where did the values along the horizontal axis come from? *It was a number line that included all values from the data set.*
- What was the significance of the squares above the horizontal axis? *Each square represented an occurrence of that value in the data set.*
- What type of information does a line plot provide? *It shows each number in on a number line. It also shows the frequency of each number.*
- Can you identify the mode from the line plot? *Yes, it is easy to see that 24 occurs more often than any of the other values.*
- Can you identify the minimum value from the line plot? If so, what is it and where is it located? *Yes, the minimum value is 18. It is the first square on the number line.*
- Can you identify the maximum value from the line plot? If so, what is it and where is it located? *Yes, the maximum value is 38. It is the last square on the number line.*
- Can you identify the median from the line plot? If so, how? *You could mark off a square from the left and the right until there is exactly one value left in the middle. This value represents the median.*
- Can you identify the mean from the line plot? *No, but you could do calculations to find the value of the mean.*

ELABORATE

The Elaborate portion of the lesson provides an opportunity for the student to apply the concepts of the TEKS within a new situation. This part of the lesson is designed for groups of three to four students.

1. Distribute the **How Far Can We Stretch?** activity sheet to each student. Read through step 1 as a class.

Facilitation Questions

- What things do you need to keep in mind before your group starts the activity so that the group and class data are comparable?
  Students should make comments about determining the procedures to use when measuring each length of stretch (i.e. measure from middle fingertip to middle fingertip, round each measurement to the nearest inch, etc.).

2. Have students follow the directions on the activity sheet to collect data on the length that each student can stretch.
3. Put the **Class Recording Sheet Transparency** on the overhead and allow students to record the stretch lengths for each student on the chart.
4. After the data from all students has been entered on the transparency, direct students to complete through problem 10 on their activity sheet.
5. Direct students to use Excel and the websites to verify their work on the activity page. Use the following facilitation questions as needed.

Facilitation Questions

- What things do you need to keep in mind when you create stem and leaf plots and line plots?
  What are the values for the stem? What are the values for the leaves? What does the horizontal axis represent? What does the vertical axis represent?
- Does one of the plots tell you more about the data than the other?
  Answers may vary. Students should realize that both plots display the data so that it is easy to determine what the data was from the problem.
- Is it easier to determine the mean, median, mode, and/or range from one of the plots than the other?
  Answers may vary. Students should realize that the mode, median, and the range are easy to determine from either plot. The mean is not easy to determine from either plot.

EVALUATE

The Evaluate portion of the lesson provides the student with an opportunity to demonstrate his or her understanding of the TEKS addressed in the lesson.

1. Provide each student with the **What is Missing?** activity sheet.
2. Upon completion of the activity sheet, use a rubric to assess student understanding of the concepts addressed in the lesson.

Answers and Error Analysis for selected response questions:

Question Number	*TEKS*	*Correct Answer*	*Conceptual Error*	*Conceptual Error*	*Procedural Error*	*Procedural Error*	*Guess*
1	6.10A	D	A	B	C		
2	6.10B	B	C	D	A		
3	6.10B	A	B	D			C
4	6.10D	B	C	D	A		

Activity Page: Seven Friends *(Possible Answers)*

Seven friends each have a package of colored chocolate candies. Some of the packages are the fun size and some of the packages are the regular size. The chart below shows how many individual colored chocolate candies each person has in his or her package.

Friend's Name	Number of Colored Chocolate Candies
Miriam	24
Martha	18
Mark	38
Maria	24
Melissa	32
Michael	36
Melinda	24

1. What was the most common number of candies in a bag?

24

2. If the bags of candy were arranged in order from the least number of candies in a bag to the greatest number of candies in a bag, which bag would be located in the exact center? How many candies would be in this bag?

One of the bags with 24 candies would be in the center

3. Who has the greatest number of candies? How many does he/she have?

Mark, 38

4. Who has the least number of candies? How many does he/she have?

Martha, 18

5. How many more candies does the person with the most have than the person with the least?

20

6. If the candies were redistributed so each person has the same amount, how many would each person have?

28

7. Open the **Seven Friends spreadsheet** and complete the activities on **sheet 1**.

Activity Page: How Far Can We Stretch? *(Possible Answers)*

1. Record the names of all of the students in your group in the chart below. Then measure across each person's back the length of how far each person can stretch. Measure from fingertip to fingertip the length in inches of each member of your group (round to the nearest inch) and record each length in the table.

Student Name	Height in Inches
Answers may vary	*Answers may vary*
Answers may vary	*Answers may vary*
Answers may vary	*Answers may vary*
Answers may vary	*Answers may vary*

2. When your group has measured and recorded the length of each person's stretch in the group, transfer the information to the chart on the overhead.

3. Record the class data on the last page of this activity.

4. Create a stem and leaf plot to display the lengths of how far the students in your class can stretch.

   Answers may vary based on class data.

5. Create a line plot to display the lengths of how far the students in your class can stretch.

   Answers may vary based on class data.

6. What are the similarities and differences in the two plots? Can you tell more about the data in one of the plots than the other? If so, which plot displays the data better? If you had to pick only one plot to display the data which one would you choose and why?
   Answers may vary based on class data.

7. What is the mean of the data? Justify your answer.
   Answers may vary based on class data.

8. What is the mode of the data? Justify your answer.
   Answers may vary based on class data.

9. What is the median of the data? Justify your answer.
   Answers may vary based on class data.

10. What is the range of the data? Justify your answer.
    Answers may vary based on class data.

11. Use the Stem and Leaf Plotter to verify your stem and leaf plot.
    http://www.shodor.org/interactivate/activities/stemleaf/index.html

12. Use the Line Plotter to verify your line plot.
    http://www.shodor.org/interactivate/activities/plop/index.html

13. Use formulas in a spreadsheet to verify your answers for mean, median, mode, and range.

14. Which method (paper and pencil or website) was easier to use to construct the Stem and Leaf Plot and Line Plot?
    Answers may vary, but the students should comment that the technology made the creation of the plots much faster.

15. How is calculating the mean, median, mode, and range from the spreadsheet different from calculating the statistics by hand? How is it the same?
    Answers may vary, but the students should not notice significant differences in the way they calculated the statistics.

16. Which method (paper and pencil or spreadsheet) was easier to use to calculate the mean, median, mode, and range? Why?
    Answers may vary, but the students should comment that the technology made the calculation of the statistics much faster.

Activity Page: What is Missing? *(Answer Key)*

There are nine sixth grade classes at Texas Middle School. Mary knows the number of students in six of the classes. The data she knows appears in the table below.

Class A	22 students	Class F	24 students
Class B	25 students	Class G	?
Class C	23 students	Class H	?
Class D	22 students	Class I	?
Class E	24 students		

She knows that the largest class has twenty-five students. She also knows the information listed below.

The mean is 23 students.
The mode is 24 students.
The median is 23 students.
The range is 5 students.

How many students are in each of the three missing classes?

Use the websites and a spreadsheet to help find the number of students in the three missing classes.

Answer: The three classes have 20 students, 24 students, and 23 students.

Transparency: Chocolate Candy

You have each been given a bag of “chocolate candy”.

Devise a strategy so that each person in your group will have the same number of candies.

Try your strategy to see if it works. Record your strategy and solution on your chart paper.

Will your strategy always work? If not, write an example of when it will not work.

Class Data	
Student Name	Length of Stretch in Inches

Activity Page: Seven Friends

Seven friends each have a package of colored chocolate candies. Some of the packages are the fun size and some of the packages are the regular size. The chart below shows how many individual colored chocolate candies each person has in his or her package.

Friend's Name	Number of Colored Chocolate Candies
Miriam	24
Martha	18
Mark	38
Maria	24
Melissa	32
Michael	36
Melinda	24

1. What was the most common number of candies in a bag?

2. If the bags of candy were arranged in order from the least number of candies in a bag to the greatest number of candies in a bag, which bag would be located in the exact center? How many candies would be in this bag?

3. Who has the greatest number of candies? How many does he/she have?

4. Who has the least number of candies? How many does he/she have?

5. How many more candies does the person with the most have than the person with the least?

6. If the candies were redistributed so each person has the same amount, how many would each person have?

7. Open the **Seven Friends spreadsheet** and complete the activities on **sheet 1**.

Activity Page: How Far Can We Stretch?

1. Record the names of all of the students in your group in the chart below. Then measure across each person's back the length of how far each person can stretch. Measure from fingertip to fingertip the length in inches of each member of your group (round to the nearest inch) and record each length in the table.

Student Name	Height in Inches

2. When your group has measured and recorded the length of each person's stretch in the group, transfer the information to the chart on the overhead.

3. Record the class data on the last page of this activity.

4. Create a stem and leaf plot to display the lengths of how far the students in your class can stretch.

5. Create a line plot to display the lengths of how far the students in your class can stretch.

6. What are the similarities and differences in the two plots? Can you tell more about the data in one of the plots than the other? If so, which plot displays the data better? If you had to pick only one plot to display the data which one would you choose and why?

7. What is the mean of the data? Justify your answer.

8. What is the mode of the data? Justify your answer.

9. What is the median of the data? Justify your answer.

10. What is the range of the data? Justify your answer.

11. Use the Stem and Leaf Plotter to verify your stem and leaf plot.
http://www.shodor.org/interactivate/activities/stemleaf/index.html

12. Use the Line Plotter to verify your line plot.
http://www.shodor.org/interactivate/activities/plop/index.html

13. Use formulas in a spreadsheet to verify your answers for mean, median, mode, and range.

14. Which method (paper and pencil or website) was easier to use to construct the Stem and Leaf Plot and Line Plot?

15. How is calculating the mean, median, mode, and range from the spreadsheet different from calculating the statistics by hand? How is it the same?

16. Which method (paper and pencil or spreadsheet) was easier to use to calculate the mean, median, mode, and range? Why?

Activity Page: What is Missing?

There are nine sixth grade classes at Texas Middle School. Mary knows the number of students in six of the classes. The data she knows appears in the table below.

Class A	22 students	Class F	24 students
Class B	25 students	Class G	?
Class C	23 students	Class H	?
Class D	22 students	Class I	?
Class E	24 students		

She knows that the largest class has twenty-five students. She also knows the information listed below.

The mean is 23 students.
The mode is 24 students.
The median is 23 students.
The range is 5 students.

How many students are in each of the three missing classes?

Use the websites and a spreadsheet to help find the number of students in the three missing classes.

http://www.shodor.org/interactivate/activities/stemleaf/index.html

http://www.shodor.org/interactivate/activities/plop/index.html

Mean, Line Plots, Stem and Leaf Plot Spreadsheet

1 Which of the following is the data set represented in the stem and leaf plot shown below?

5	6 8 9
6	1 3 4 5
7	0

A 0, 1, 3, 4, 5, 6, 7, 8, 9

B 50, 60, 70

C 5689, 61345, 70

D 56, 58, 59, 61, 63, 64, 65, 70

2 The range in weight of several boxes in a warehouse is 25 pounds. If the greatest weight of a box is 78 pounds, how much does the lightest box weigh?

A 25 pounds

B 53 pounds

C 103 pounds

D 128 pounds

3 Andrew kept a record of his bowling scores. The scores are shown in the table below.

Game	Score
1	150
2	140
3	170
4	200
5	140

What is the mean of his scores?

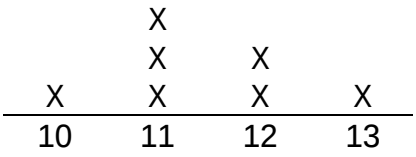
A 160

B 140

C 200

D 170

4 The line plot shows the ages of the grandchildren in a large family.



Which statement does the information in the line plot support?

A There are just as many grandchildren that are 11 years old as grandchildren that are 12 years old.

B There are six grandchildren that are 11 years old or older.

C There are more grandchildren that are 11 years old than grandchildren that are 12 years old or 13 years old.

D There are two grandchildren that are 12 years old or older.

Simple Probability, Bar and Circle Graphs Spreadsheet

Mathematics

6.9 The student uses experimental and theoretical probability to make predictions. The student is expected to

(B) find the probabilities of a simple event and its complement and describe the relationship between the two.

6.10 The student uses statistical representations to analyze data.

(A) select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot.

(C) sketch circle graphs to display data.

(D) solve problems by collecting, organizing, displaying, and interpreting data.

Technology Applications

The student demonstrates knowledge and appropriate use of hardware components, software programs, and their connections. The student is expected to:

(1)(a) demonstrate knowledge and appropriate use of operating systems, software applications, and communicate and networking components.

(1)(c) demonstrate the ability to select and use software for a defined task according to quality, appropriateness, effectiveness, and efficiency.

(1)(f) perform basic software application function including, but not limited to, opening an application program and creating, modifying, printing, and saving documents.

The student uses appropriate computer-based productivity tools to create and modify solutions to problems. The student is expected to:

(7)(b) plan, create, and edit spreadsheet documents using all data types, formulas and functions, and chart information.

Materials

Advanced Preparation:

- Students should have access to computers with a spreadsheet program and/or a projection device to use a spreadsheet as a class demonstration.
- Copy the **Prize Dilemma** and **Spinner Creation** transparencies for the overhead.
- Copy the **Activity Master: Let's Match It** onto colored card stock and cut into sets one for each student group.

For each student:

- **What Color?** activity sheet
- **You Design It** activity sheet

Simple Probability, Bar and Circle Graphs Spreadsheet

For each student group of 3 - 4 students:

- Chart paper
- Markers
- Rulers
- Compass or large circular objects
- Protractors
- Color Tiles
- Paper bag (lunch size)
- **Let's Match It** card set

For whole group instruction:

- Transparencies: **Prize Dilemma** and **Spinner Creation**

Simple Probability, Bar and Circle Graphs Spreadsheet

ENGAGE

The Engage portion of the lesson is designed to create student interest in the development and understanding of simple probability as well as the creation of bar graphs and circle graphs. This part of the lesson is designed for groups of 3 to 4 students.

1. Place **Prize Dilemma** transparency on the overhead.
2. Distribute a piece of chart paper and markers to each student group.
3. Give student groups time to work the problem and record their solution on chart paper.

Facilitation Questions – Engage Phase

- Which spinner should the store choose? Why? *Spinner D, the spinner contains the smallest amount of area for cameras.*
- Which spinner should the customer choose? Why? *Spinner A, the spinner contains the largest amount of area for cameras.*
- How many different prizes are available? *4 (DVD, CD, Games and Camera)*
- Which spinner would allow an equal chance of winning each prize? *Spinner A, because all section are the same size.*
- In spinner A, how could you describe the chances of landing on a space labeled CD? DVD? Video Game? Camera? *1 out of 4 for each prize*
- Which spinner provides the greatest chance of winning the CD? How did you determine the answer? *Spinner C, more sections are assigned CD, and CD's cover half the circle.*
- In spinner C, how could you describe the chances of landing on a space labeled CD? *1 out 2*
- In spinner C, how could you describe the chances of landing on a space labeled DVD? Video Game? Camera? *1 out of 6 for each prize.*
- Which spinner would give a customer a 3 out of 8 chance of winning a CD? How did you determine the answer? *Spinner D, because it has eight section and three of them are CD's.*

All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

4. Place **Spinner Creation** transparency on the overhead.
5. Distribute a second piece of chart paper, rulers, protractors and compasses (or large round objects to make circles on the chart paper.)
6. Give student groups time to create the spinners on the piece of chart paper.
7. Use a Gallery Tour to allow students to examine other groups' solutions to all the questions: Prize Dilemma and Spinner Creation.
8. Use the Facilitation Question on the next page to debrief Gallery Tour.

Facilitation Questions – Engage Phase

- What do you notice about the spinners that were created for the electronics store to use so that it would never have to give away a digital camera? *Answers may vary. Digital cameras are not found on the spinner.*
- What is the probability of landing on a digital camera for these spinners? Why? *Zero*, *because the digital camera is not a possible outcome.*
- What do you notice about the spinners that were created for the electronics store to use so that the customer would always win a digital camera? *Answers may vary. The whole spinner is digital camera.*
- What is the probability of landing on a digital camera for these spinners? Why? *100%, because the digital camera is the only possible outcome.*
- In the spinner you created so that the customer's chance of winning a DVD was better than a video game, how many sections did you label DVD and how many sections did you label video game? *Answers may vary*
- In the spinner you created so that the customer's chance of winning a CD was the same as not winning a CD, how many of the sections did you label CD and how many did you not label CD? *Answers may vary.*

* All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

EXPLORE

The Explore portion of the lesson provides the student with an opportunity to be actively involved in the exploration of the mathematical concepts addressed. This part of the lesson is designed for groups of three to four students.

1. Distribute the **What Color?** activity sheet.
2. Distribute a sheet of chart paper, a paper bag, some red color tiles, some blue color tiles, and some green color tiles to each student group.
3. Students will need access to the spreadsheet **What Color?**
4. Allow student groups time to work through the activity sheet.
   Note: If students are not familiar with the operation of a spreadsheet, they will need the necessary instruction at this time. Use a Gallery Tour to allow students to examine other groups' solutions.

Facilitation Questions – Explore Phase

- What fraction of the color tiles is red? How did you determine the answer? $\frac{3}{5}$
- What percent of the color tiles is red? How did you determine the answer? *60%*
- What fraction of the color tiles is blue? How did you determine the answer? $\frac{1}{5}$
- What percent of the color tiles is blue? How did you determine the answer? *20%*
- What fraction of the color tiles is green? How did you determine the answer? $\frac{1}{5}$
- What percent of the color tiles is green? How did you determine the answer? *20%*
- What is another way without using a fraction to describe the chance of getting each color? *3 out of 5 chances to get red, 1 out of 5 chances to get blue, and 1 out of 5 chances to get green.*
- What information do you need to sketch a circle graph?
  The number of sections needed to divide the circle into, and the labels of each section.
- How can you determine the number of times you will draw a particular color if you increase the number of draws from the bag?
  Multiply the fraction of getting the color you want from the original problem by the scale factor used to enlarge the set.

EXPLAIN

The Explain portion of the lesson is directed by the teacher to allow the students to formalize their understanding of the TEKS addressed in the lesson.

1. Debrief the **What Color?** activity.

Facilitation Questions – Explain Phase

- How did you and your group determine how many tiles of each color to put in the bag? *Counted the number of reds, blues, and greens from the bar graph.*
- How did you and your group determine the likelihood Mary would draw a red tile? *Determined the number of red tiles in the bag compared to the total number of tiles in the bag.*
- What does this part-whole ratio represent? *The numerator represents the number of tiles there are of one color, and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a blue tile? *Determined the number of blue tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a blue tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of blue tiles, and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a green tile? *Determined the number of green tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a green tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of green tiles, and the denominator represents the total number of tiles.*
- A part-whole relationship describes the theoretical probability of getting a particular outcome. What is the theoretical probability of drawing a red tile? $\frac{3}{5}$ A blue tile? $\frac{1}{5}$ A green tile? $\frac{1}{5}$

* All questions should be extended with a follow-up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

Facilitation Questions – Explain Phase

- What is the theoretical probability of not drawing a red tile? $\frac{2}{5}$
- What do you notice about the theoretical probability of drawing a red tile and not drawing a red tile? *The sum of the probabilities is 1.*
- What is the theoretical probability of not drawing a blue tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a blue tile and not drawing a blue tile? *The sum of the probability is 1.*
- What is the theoretical probability of not drawing a green tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a green tile and not drawing a green tile? *The sum of the probabilities is 1.*
- How did you and your group determine how many of the tiles in the 100 draws should be red, blue, and green? *Answers may vary. Students should say something about converting the fractions to percentages using benchmark mark fractions.*
- How could you find the theoretical probability of drawing a particular color if the number of draws was a number other than the original 5 or 100? *Determine the scale factor used to generate the number of draws compared to the original 5 tiles. Then multiply the theoretical probability of getting the particular color by the scale factor.*
- If Mary drew 25 tiles from the bag, how many of the tiles should be red? *15* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be blue? *5* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be green? *5* How did you determine the answer?
- How does the spreadsheet create the circle graph? *Find the total number of sections to know how many sections to make and then label each section according to the number of each color.*
- How did you and your group create a circle graph? *Divided the circle into the same number of sections as total tiles in the bag. Labeled each section to correspond to each of the color tiles.*
- Which one of the graphs (bar or circle), if either, tells you more about the data than the other? *Answers may vary.*

* All questions should be extended with a follow-up question like “How did you determine the answer?” or “Did anyone get the answer using a different strategy?”

ELABORATE

The Elaborate portion of the lesson provides an opportunity for the student to apply the concepts of the TEKS within a new situation. This part of the lesson is designed for groups of three to four students.

1. Distribute to each student group a set of **Let's Match It** cards, a sheet of chart paper, and markers.
2. Inform students that they will be matching a graph card to a spinner card and 5 statement cards that would match the graph and spinner.
3. Allow student groups time to work through the activity.
4. Assign each student group one match to put on chart paper.

Facilitation Questions – Elaborate Phase

- How did your group decide how to sort the cards?
  Put the bar graphs together, the circle graphs together, and the description cards together.
- How did your group determine which bar graph and which circle graph to match together?
  Look to see what the total number of items is for both, and then look at the number of each color.
- How did your group decide which cards to match with the circle graphs and the bar graph?
  Answers may vary. Students should describe how they looked at the card and then tried to determine which circle graph had the probability listed on the card.
- How did your group check to make sure your match was accurate?
  Answers may vary.

EVALUATE

The Evaluate portion of the lesson provides the student with an opportunity to demonstrate his or her understanding of the TEKS addressed in the lesson.

1. Distribute the **You Design It** activity sheet to each student.
2. Upon completion of the activity sheet, use a rubric to assess student understanding of the concepts addressed in the lesson.

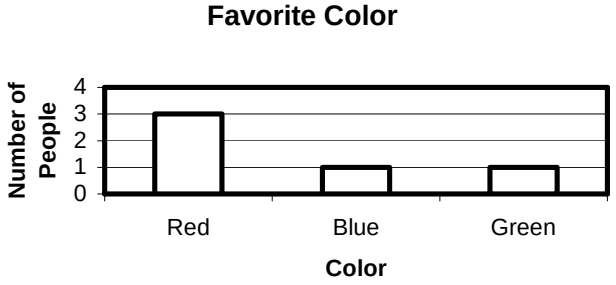
Simple Probability, Bar and Circle Graphs Spreadsheet

Answers and Error Analysis for selected response questions:

Question Number	*TEKS*	*Correct Answer*	*Conceptual Error*	*Conceptual Error*	*Procedural Error*	*Procedural Error*	*Guess*
1	6.9B	D	B	C	A		
2	6.9B	A	B	C	D		
3	6.10C	A	C		B	D	
4	6.10D	B	C	D	A		

What Color? - (Possible Answers)

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

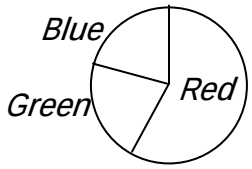
1. How many color tiles of each color should she put in the bag? Justify your answer.
   3 red, 1 blue, and 1 green

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?
   3 chances out of 5

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?
   1 chance out of 5

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?
   1 chance out of 5

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.



6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

(Continue: What Color?)

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

8. How many of the 25 draws should Mary expect to be red? Why?
   15

9. How many of the 25 draws should Mary expect to be blue? Why?
   5

10. How many of the 25 draws should Mary expect to be green? Why?
    5

You will need to model the same experiment that Mary did.

- **Create a frequency table like the one below on the chart paper**
- **Put a color tile for each student vote in the bag**
- **Draw a color tile at random from the bag**
- **Record the color of the tile on the chart paper and worksheet**
- **Return the tile to the bag**
- **Repeat this process 25 times**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

11. What was your experimental probability of drawing a red?
    Answers may vary.

12. What was your experimental probability of drawing a blue?
    Answers may vary.

13. What was your experimental probability of drawing a green?
    Answers may vary.

(Continue: What Color?)

14. How did the number of red tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

15. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

16. How did the number of green tiles you drew compare to the number you said Mary should have drawn?
    Answers may vary.

17. How close was your prediction to the actual results?
    Answers may vary.

Open the *What Color?* spreadsheet file.

- **Select *Sheet 1* and follow the directions to simulate the experiment.**
- **Select *Sheet 2* and follow the directions to create a circle graph.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles of one color in the bag compared to total number of tiles in the bag is called the *Theoretical Probability* of selecting a tile of that color.

18. How close was your prediction to the actual results? (Record your response on the chart paper.)

19. What could you do to get your experimental probability to be closer to the theoretical probability? (Record your response on the chart paper.)
    Perform more trials.

You Design It - (Possible Answers)

Open a spreadsheet document. Use the spreadsheet to design a spinner that has each of the theoretical probabilities listed in the table.

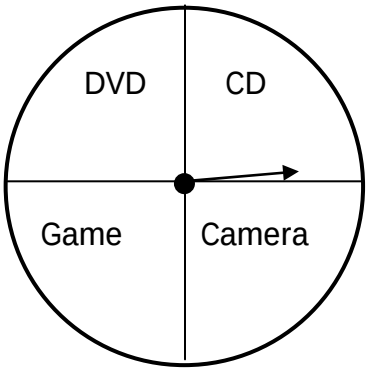
P(Red)	$= \frac{1}{3}$
P(Blue)	$= \frac{1}{4}$
P(Green)	$= \frac{1}{4}$
P(Yellow)	$= \frac{1}{6}$

Explain how you designed your spinner.

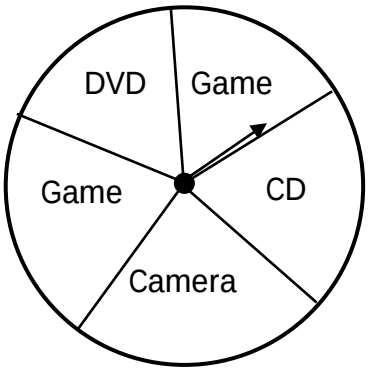
Answers may vary. However, the spinner should have 12 sections with 4 labeled red, 3 labeled blue, 3 labeled green, and 2 labeled yellow.

Prize Dilemma - Transparency

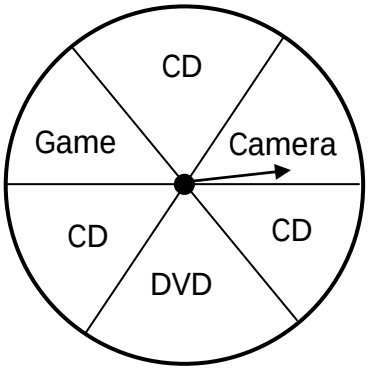
An electronics store is giving away prizes to its customers. Each customer will spin a spinner and receive the prize that the spinner lands on. The four spinners shown below are the spinners the company is considering using.



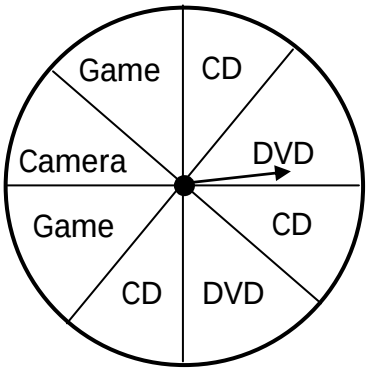
Spinner A



Spinner B



Spinner C



Spinner D

1. If the store wants to give away as few digital cameras as possible, which spinner should it offer each customer to use? Justify your answer.

2. If a customer can select any spinner and he or she wants the best chance to win the digital camera, which spinner should he or she use? Justify your answer.

Spinner Creation - Transparency

3. Create a spinner for the electronics store to use so that it would never have to give away a digital camera. Justify your spinner.

4. Create a spinner that the customer could use so that he or she would win a digital camera every time. Justify your spinner.

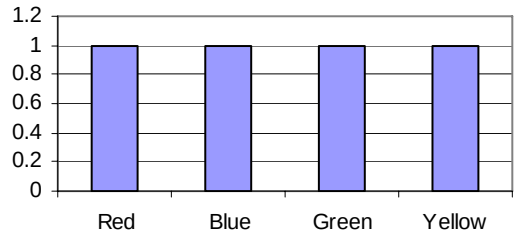
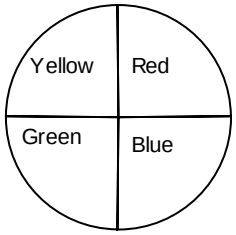
5. Create a spinner so the customer's chance of winning a DVD is better than the chance of winning a video game. Justify your spinner.

6. Create a spinner so that the customer's chance of winning a CD is the same as not winning a CD. Justify your spinner.

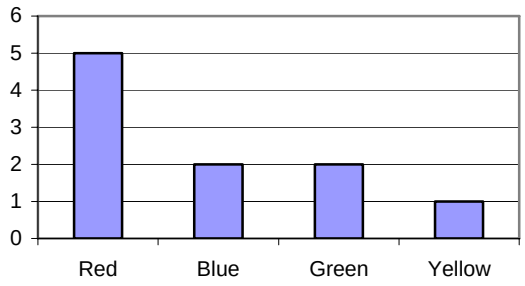
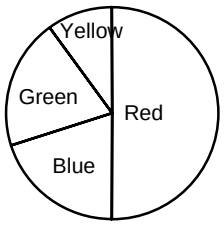
Let's Match It - Activity Master

Let's Match It 	Let's Match It 
Let's Match It 	Let's Match It 
Let's Match It 	Let's Match It 
Let's Match It 	Let's Match It 

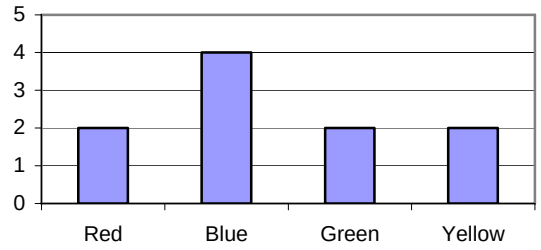
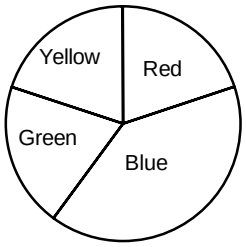
Let's Match It - Activity Master

	
The theoretical probability of drawing red is $\frac{1}{4}$.	The theoretical probability of NOT drawing green is $\frac{3}{4}$.
The theoretical probability of drawing yellow is $\frac{1}{4}$.	The theoretical probability of NOT drawing blue is $\frac{3}{4}$.
A bag contains four marbles: 1 red, 1 blue, 1 yellow, and 1 green marble.	

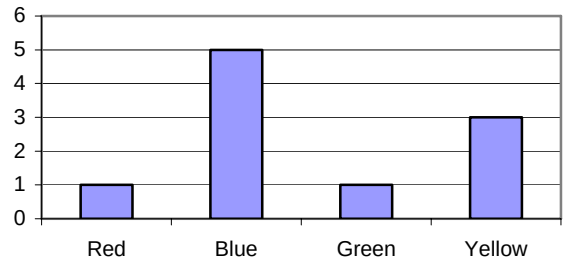
Let's Match It - Activity Master

	
The theoretical probability of NOT drawing red is $\frac{1}{2}$.	The theoretical probability of drawing blue is $\frac{1}{5}$.
The theoretical probability of drawing green is $\frac{1}{5}$.	The theoretical probability of NOT drawing yellow is $\frac{9}{10}$.
A bag contains 10 marbles: 5 red, 2 blue, 1 yellow, and 2 green marbles.	

Let's Match It - Activity Master

	
The theoretical probability of drawing red is $\frac{1}{5}$.	The theoretical probability of NOT drawing blue is $\frac{3}{5}$.
The theoretical probability of NOT drawing yellow is $\frac{4}{5}$.	The theoretical probability of drawing green is $\frac{1}{5}$.
A bag contains 10 marbles: 2 red, 4 blue, 2 yellow, and 2 green marbles.	

Let's Match It - Activity Master

<table>
<tr>
<td> 
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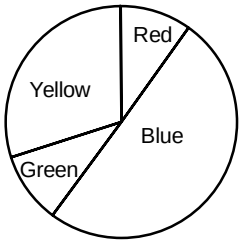
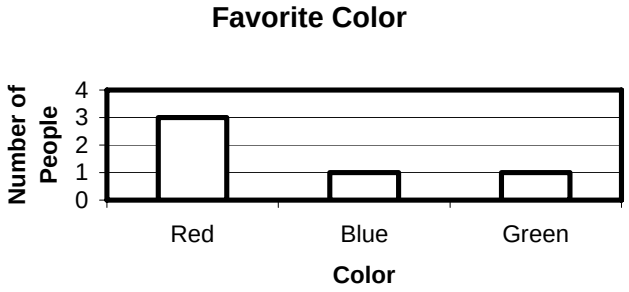
<td> 
</td>
</tr>
<tr>
<td>The theoretical probability of NOT drawing yellow is $\frac{7}{10}$.</td>
<td>The theoretical probability of drawing green is $\frac{1}{10}$.</td>
</tr>
<tr>
<td>The theoretical probability of NOT drawing blue is $\frac{1}{2}$.</td>
<td>The theoretical probability of drawing red is $\frac{1}{10}$.</td>
</tr>
<tr>
<td>A bag contains 10 marbles: 1 red, 5 blue, 3 yellow, and 1 green marble.</td>
<td></td>
</tr>
</table>

Simple Probability, Bar and Circle Graphs Spreadsheet

What Color?

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

1. How many color tiles of each color should she put in the bag? Justify your answer.

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.

6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

(Continue: What Color?)

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

8. How many of the 25 draws should Mary expect to be red? Why?

9. How many of the 25 draws should Mary expect to be blue? Why?

10. How many of the 25 draws should Mary expect to be green? Why?

You will need to model the same experiment that Mary did.

- **Create a frequency table like the one below on the chart paper.**
- **Put a color tile for each student vote in the bag.**
- **Draw a color tile at random from the bag.**
- **Record the color of the tile on the chart paper and worksheet.**
- **Return the tile to the bag.**
- **Repeat this process 100 times.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

11. What was your experimental probability of drawing a red?

12. What was your experimental probability of drawing a blue?

13. What was your experimental probability of drawing a green?

(Continue: What Color?)

14. How did the number of red tiles you drew compare to the number you said Mary should have drawn?

15. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?

16. How did the number of green tiles you drew compare to the number you said Mary should have drawn?

17. How close was your prediction to the actual results?

Open the *What Color?* spreadsheet file.

- **Select *Sheet 1* and follow the directions to simulate the experiment.**
- **Select *Sheet 2* and follow the directions to create a circle graph.**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles of one color in the bag compared to total number of tiles in the bag is called the *Theoretical Probability* of selecting a tile of that color.

18. How close was your prediction to the actual results? (Record your response on the chart paper.)

19. What could you do to get your experimental probability to be closer to the theoretical probability? (Record your response on the chart paper.)

You Design It

Open a spreadsheet document. Use the spreadsheet to design a spinner that has each of the theoretical probabilities listed in the table.

P(Red) = $\frac{1}{3}$
P(Blue) = $\frac{1}{4}$
P(Green) = $\frac{1}{4}$
P(Yellow) = $\frac{1}{6}$

Explain how you designed your spinner.

Simple Probability, Bar and Circle Graphs Spreadsheet

1 Alan has 3 peppermint candies, 8 cinnamon candies, 4 root beer candies, and 6 butterscotch candies in a bag. If he draws a piece of candy at random from the bag, what is the probability he will draw a piece of butterscotch candy?

A $\frac{5}{7}$

B $\frac{3}{5}$

C $\frac{2}{5}$

D $\frac{2}{7}$

2 Mary has a quarter to buy a gumball from a machine. In the machine there are 3 red gumballs, 4 blue gumballs, 3 yellow gumballs, and 2 green gumballs. What is the probability that Mary will NOT get a yellow gumball when she puts her quarter in the machine to buy a gumball?

A $\frac{3}{4}$

B $\frac{2}{3}$

C $\frac{1}{3}$

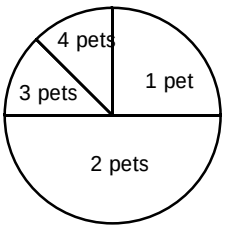
D $\frac{1}{4}$

3 Alicia conducted a survey about the number of pets people owned. The results of the survey are shown in the table below.

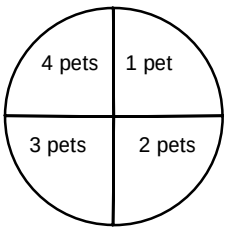
Number of Pets

Number of Pets	People
1	50
2	100
3	25
4	25

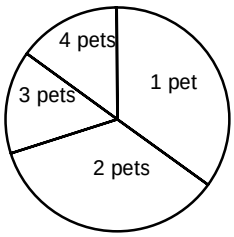
A

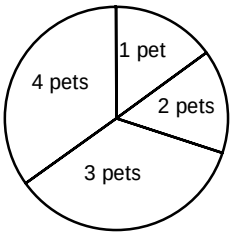


C

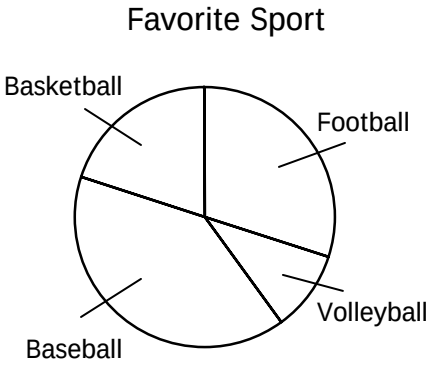


B





4 The circle graph shows the results of a survey about students' favorite sports.



Which statement is supported by the information in the circle graph?

A Football is the most popular sport.

B More people said baseball was their favorite sport than basketball.

C Basketball is the least favorite sport.

D More people said basketball was their favorite sport than football.

Mathematics

6.9 The student uses experimental and theoretical probability to make predictions. The student is expected to

(B) find the probabilities of a simple event and its complement and describe the relationship between the two.

6.10 The student uses statistical representations to analyze data. The student is expected to

(A) select and use an appropriate representation for presenting and displaying different graphical representations of the same data including line plot, line graph, bar graph, and stem and leaf plot.

(C) sketch circle graphs to display data.

(D) solve problems by collecting, organizing, displaying, and interpreting data.

Materials

Advanced Preparation:

- Students should have access to TI 73 calculators and the teacher should have a projection device to display the TI 73 on the overhead or TV.
- Copy the **Prize Dilemma** and **Spinner Creation** transparencies for the overhead.
- Copy the activity master, **Let's Match It**, onto colored card stock and cut into sets one for each student group.

For each student:

- TI 73 Graphing Calculator
- **What Color?** activity sheet
- **You Design It** activity sheet

For each student group of 3 - 4 students:

- Chart paper
- Markers
- Rulers
- Compass or large circular objects
- Protractors
- Color Tiles
- Paper bag (lunch size)
- **Let's Match It** card set

For whole group instruction:

- Transparencies: **Prize Dilemma** and **Spinner Creation**

ENGAGE

The Engage portion of the lesson is designed to create student interest in the development and understanding of simple probability as well as creating bar graphs and circle graphs. This part of the lesson is designed for groups of three to four students.

1. Place **Prize Dilemma** transparency on the overhead.
2. Distribute a piece of chart paper and markers to each student group. Have groups fold the chart paper in half.
3. Give student groups time to work the problem and record their solution on one half of the chart paper.

Facilitation Questions – Engage Phase

- Which spinner should the store choose? Why? *Spinner D, the spinner contains the smallest amount of area for cameras.*
- Which spinner should the customer choose? Why? *Spinner A, the spinner contains the largest amount of area for cameras.*
- How many different prizes are available? *4 (DVD, CD, Games and Camera)*
- Which spinner is designed so that each prize would have an equal chance of being won? How did you determine the answer? *Spinner A, because all section are the same size.*
- In spinner A, how could you describe the chances of landing on a space labeled CD? DVD? Video Game? Camera? *1 out of 4 for each prize*
- Which spinner is designed so that the CD has the greatest change of being won? How did you determine the answer? *Spinner C, more sections are assigned CD, and CD's cover half the circle.*
- In spinner C, how could you describe the chances of landing on a space labeled CD? *1 out 2*
- In spinner C, how could you describe the chances of landing on a space labeled DVD? Video Game? Camera? *1 out of 6 for each prize.*
- Which spinner would give a customer a 3 out of 8 chance of winning a CD? How did you determine the answer? *Spinner D, because it has eight sections and three of them are CD's.*

* All questions should be extended with a follow up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

4. Place **Spinner Creation** transparency on the overhead.
5. Distribute rulers, protractors and compasses (or large round objects to make circles on the chart paper.)
6. Give student groups time to create the spinners on other half of the piece of chart paper.

7. Use a Gallery Tour to allow students to examine other groups' solutions to all the questions: Prize Dilemma and Spinner Creation.
8. Use the Facilitation Question on the next page to debrief Gallery Tour.

Facilitation Questions – Engage Phase

- What do you notice about the spinners that were created for the electronics store to use so that they would never have to give away a digital camera? *Answers may vary. Digital cameras' are not found on the spinner.*
- What is the probability of landing on a digital camera for these spinners? Why? *Zero, because the digital camera is not a possible outcome.*
- What do you notice about the spinners that were created for the electronics store to use so that the customer would always win a digital camera? *Answers may vary. The whole spinner is digital camera.*
- What is the probability of landing on a digital camera for these spinners? Why? *100%, because the digital camera is the only possible outcome.*
- In the spinner you created so that the customer's chance of winning a DVD was better than a video game, how many sections were labeled DVD and how many sections were labeled video game? *Answers may vary*
- In the spinner you created so that the customer's chance of winning a CD was the same as not winning a CD, how many of the sections were labeled CD and how many were not labeled CD? *Answers may vary.*

* All questions should be extended with a follow up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

EXPLORE

The Explore portion of the lesson provides the student with an opportunity to be actively involved in the exploration of the mathematical concepts addressed. This part of the lesson is designed for groups of three to four students.

1. Distribute the **What Color?** activity sheet.
2. Distribute a sheet of chart paper, a paper bag, some red color tiles, some blue color tiles, and some green color tiles to each student group.
3. Students will need a TI-73 graphing calculator.
4. Allow student groups time to work through the activity sheet.
   Note: If students are not familiar with the operation of a TI-73 graphing calculator they will need the necessary instruction at this time. Use a Gallery tour to allow students to examine other groups' solutions.

Facilitation Questions – Explore Phase

- What fraction of the color tiles is red? $\frac{3}{5}$ How did you determine the answer?
- What percent of the color tiles is red? *60%* How did you determine the answer?
- What fraction of the color tiles is blue? $\frac{1}{5}$ How did you determine the answer?
- What percent of the color tiles is blue? *20%* How did you determine the answer?
- What fraction of the color tiles is green? $\frac{1}{5}$ How did you determine the answer?
- What percent of the color tiles is green? *20%* How did you determine the answer?
- What is another way without using a fraction to describe the chance of getting each color? *3 out of 5 chances to get red, 1 out of 5 chances to get blue, and 1 out of 5 chances to get green.*
- What information do you need to sketch a circle graph?
  The number of sections needed to divide the circle into, and the labels of each section.
- How can you determine the number of times you will draw a particular color if you increase the number of draws from the bag?
  Multiply the fraction of getting the color you want from the original problem by the scale factor used to enlarge the set.

EXPLAIN

The Explain portion of the lesson is directed by the teacher to allow the students to formalize their understanding of the TEKS addressed in the lesson.

1. Debrief the **What Color?** activity sheet.

Facilitation Questions – Explain Phase

- How did you and your group determine how many tiles of each color to put in the bag? *Counted the number of reds, blues, and greens from the bar graph.*
- How did you and your group determine the likelihood Mary would draw a red tile? *Determined the number of red tiles in the bag compared to the total number of tiles in the bag.*
- What does this part-whole ratio represent? *The numerator represents the number of tiles there are of one color and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a blue tile? *Determined the number of blue tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a blue tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of blue tiles and the denominator represents the total number of tiles.*
- How did you and your group determine the likelihood Mary would draw a green tile? *Determined the number of green tiles in the bag compared to the total number of tiles in the bag.*
- What part-whole ratio represents the likelihood that Mary would draw a green tile? $\frac{1}{5}$
- What does this part-whole ratio represent? *The numerator represents the number of green tiles and the denominator represents the total number of tiles.*
- A part-whole relationship describes the theoretical probability of getting a particular outcome. What is the theoretical probability of drawing a red tile? $\frac{3}{5}$

  A blue tile? $\frac{1}{5}$ A green tile? $\frac{1}{5}$

* All questions should be extended with a follow up question like “How did you determine the answer?” or “Did anyone get the answer using a different strategy?”

Facilitation Questions – Explain Phase

- What is the theoretical probability of not drawing a red tile? $\frac{2}{5}$
- What do you notice about the theoretical probability of drawing a red tile and not drawing a red tile? *The sum of the probabilities is 1.*
- What is the theoretical probability of not drawing a blue tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a blue tile and not drawing a blue tile? *The sum of the probability is 1.*
- What is the theoretical probability of not drawing a green tile? $\frac{3}{5}$
- What do you notice about the theoretical probability of drawing a green tile and not drawing a green tile? *The sum of the probabilities is 1.*
- How did you and your group create a circle graph? *Divided the circle into the same number of sections as total tiles in the bag. Labeled each section to correspond to each of the color tiles.*
- Which one of the graphs (bar or circle), if either, tell you more about the data than the other? *Answers may vary.*
- How did you and your group determine how many of the tiles in the 100 draws should be red, blue, and green? *Answers may vary. Students should say something about converting the fractions to percentages using benchmark mark fractions.*
- How could you find the theoretical probability of drawing a particular color if the number of draws was a number other than the original 5 or 100? *Determine the scale factor used to generate the number of draws compared to the original 5 tiles. Then multiply the theoretical probability of getting the particular color by the scale factor.*
- If Mary drew 25 tiles from the bag, how many of the tiles should be red? *15* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be blue? *5* How did you determine the answer?
- If Mary drew 25 tiles from the bag, how many of the tiles should be green? *5* How did you determine the answer?
- How does the spreadsheet create the circle graph? *Find the total number of sections to know how many sections to make and then label each section according to how many is each color.*

* All questions should be extended with a follow up question like “How did you determine the answer?” or “Did anyone get the answer using a different strategy?”

Facilitation Questions – Explain Phase

- How did you and your group create a circle graph? *Divided the circle into the same number of sections as total tiles in the bag. Labeled each section to correspond to each of the color tiles.*
- Which one of the graphs (bar or circle), if either, tell you more about the data than the other? *Answers may vary.*
- How does the calculator create the circle graph? *Find the total number of sections to know how many sections to make and then label each section according to how many is each color.*

* All questions should be extended with a follow up question like "How did you determine the answer?" or "Did anyone get the answer using a different strategy?"

ELABORATE

The Elaborate portion of the lesson provides an opportunity for the student to apply the concepts of the TEKS within a new situation. This part of the lesson is designed for groups of three to four students.

1. Distribute to each group a set of **Let's Match It** cards, a sheet of chart paper, and markers.
2. Inform students that they will be matching a graph card to a spinner card and 5 statement cards that would match the graph and spinner.
3. Allow student groups time to work through the activity.
4. Assign each student group one match to record on chart paper.

Facilitation Questions – Elaborate Phase

- How did your group decide how to sort the cards?
  Put the bar graphs together, the circle graphs together, and the description cards together.

- How did your group determine which bar graph and which circle graph should be matched together?
  Look to see what the total number of items is for both and then look at the number of each color.

- How did your group decide which cards to match with the circle graphs and the bar graph?
  Answers may vary. Students should describe how they looked at the card and then tried to determine which circle graph had the probability listed on the card.

- How did your group check to make sure your match was accurate?
  Answers may vary.

EVALUATE

The Evaluate portion of the lesson provides the student with an opportunity to demonstrate his or her understanding of the TEKS addressed in the lesson.

1. Distribute the **You Design It** activity sheet to each student.
2. Upon completion of the activity sheet, a rubric should be used to assess student understanding of the concepts addressed in the lesson.

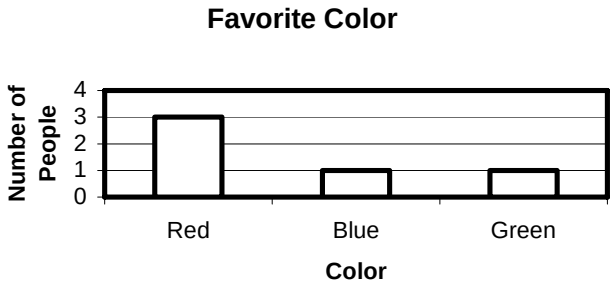
Answers and Error Analysis for selected response questions:

Question Number	*TEKS*	*Correct Answer*	*Conceptual Error*	*Conceptual Error*	*Procedural Error*	*Procedural Error*	*Guess*
1	6.9B	D	B	C	A		
2	6.9B	A	B	C	D		
3	6.10C	A	C		B	D	
4	6.10D	B	C	D	A		

What Color? - (Possible Answers)

Part I.

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

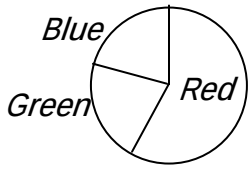
1. How many color tiles of each color should she put in the bag? Justify your answer.
   3 red, 1 blue, and 1 green

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?
   3 chances out of 5

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?
   1 chance out of 5

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?
   1 chance out of 5

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.



6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

Part II.

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

1. How many of the 25 draws should Mary expect to be red? Why?
   15

2. How many of the 25 draws should Mary expect to be blue? Why?
   5

3. How many of the 25 draws should Mary expect to be green? Why?
   5

The number of possible outcomes (how many tiles of a color) out of all possible outcomes (total number of tiles) is called the *Theoretical Probability*

Model the same experiment that Mary did using color tiles and a bag.

- **Create a frequency table like the one below on the chart paper**
- **Put a color tile for each student vote in the bag**
- **Draw a color tile at random from the bag**
- **Record the color of the tile on the chart paper and worksheet**
- **Return the tile to the bag**
- **Repeat this process 25 times**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

4. What was your experimental probability of drawing a red?, a blue?, a green?
   Answers may vary.

5. How did the number of red tiles you drew compare to the number you said Mary should have drawn?
   Answers may vary.

(Continue: What Color? – Part II.)

6. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?
   Answers may vary.

7. How did the number of green tiles you drew compare to the number you said Mary should have drawn?
   Answers may vary.

8. How close was your prediction to the actual results?
   Answers may vary.

9. What could you do to get your experimental probability to be closer to the theoretical probability?
   Perform more trials.

10. Predict what would happen if you continued the experiment for 100 more draws.
    The experimental probability should move closer to the theoretical probability.

11. Sketch a circle graph of the experimental data on the chart paper.

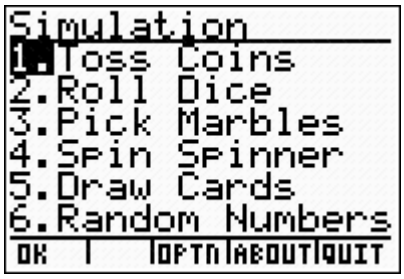
Part III.

Model Mary's experiment using the TI-73 calculator, and create a circle graph of the collected. Create a second frequency table like the one in Part I on the chart paper. Record the results on the chart paper and worksheet

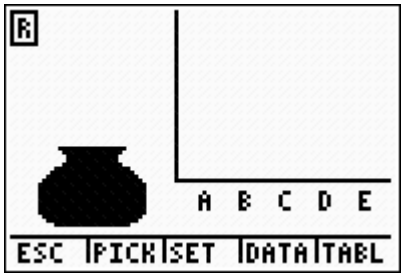
By using the TI-73 calculator to simulate the experiment a large data set can be collected in a very short amount of time.

A. [ON]→[APPS] → (Prob Sim)→[ENTER]

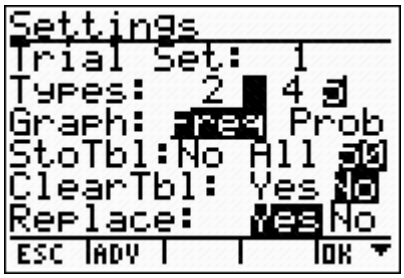
B. [3] *(Pick Marbles)*



C. [ZOOM] *(Set for settings)*



D. Under Settings, set up as illustrated.
   Trial Set: 1
   Types: 3
   Replace: Yes



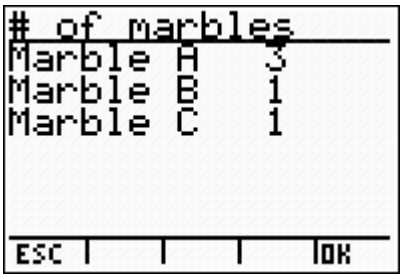
(Continue: What Color? – Part III.)

E. WINDOW
Under # of marbles, set up colors as illustrated.

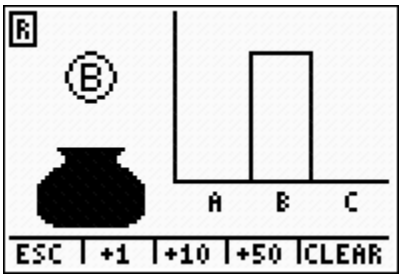
Red → Marble A: 3

Blue → Marble B: 1

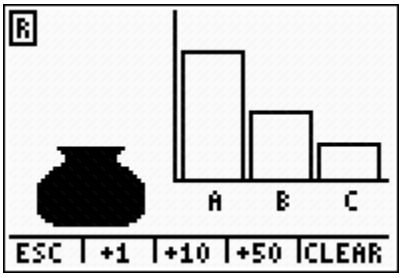
Green →Marble C: 1



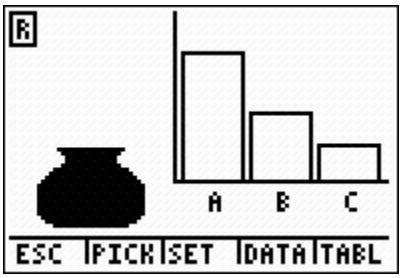
F. ENTER



G. TRACE
(this will simulate 50 trials)

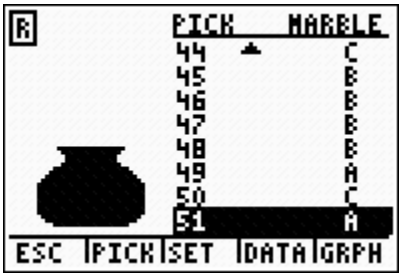


H. GRAPH
(this will show a table of the data generated)



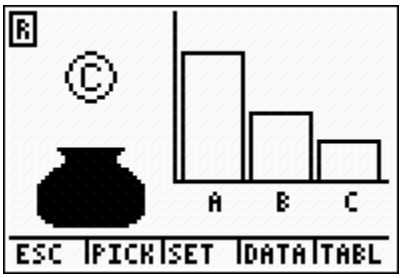
I. TRACE

Copy the data into the frequency table.



(Continue: What Color? – Part III.)

J. Sketch the graph on chart paper.



1. What was the experimental probability of drawing a red?, a blue?, a green?
   Answers may vary.

2. Has the experimental probability moved closer to the theoretical probability? Justify your answer.
   Answers may vary.

You Design It – (Possible Answers)

Use a graphing calculator to design a spinner that has each of the theoretical probabilities listed in the table.

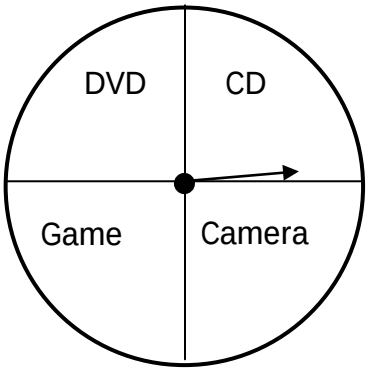
P(Red) = $\frac{1}{3}$
P(Blue) = $\frac{1}{4}$
P(Green) = $\frac{1}{4}$
P(Yellow) = $\frac{1}{6}$

Explain how you designed your spinner.

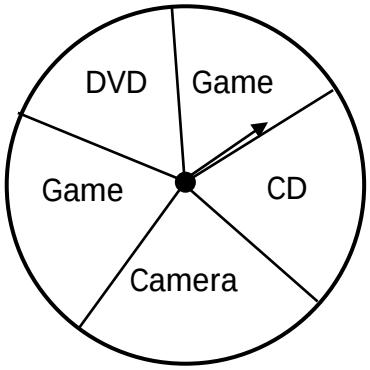
Answers may vary. However, the spinner should have 12 sections with 4 labeled red, 3 labeled blue, 3 labeled green, and 2 labeled yellow.

Prize Dilemma - Transparency

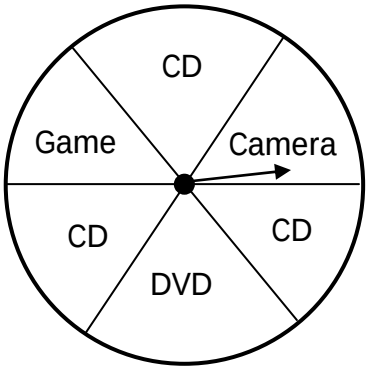
An electronics store is giving away prizes to its customers. Each customer will spin a spinner and receive the prize that the spinner lands on. The four spinners shown below are the spinners the company is considering using.



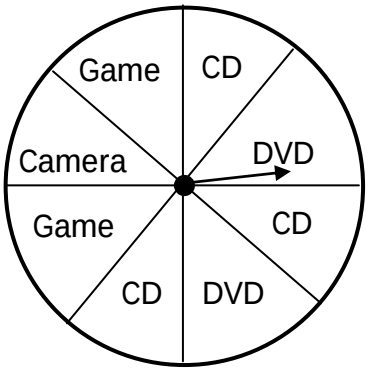
Spinner A



Spinner B



Spinner C



Spinner D

1. If the store wants to give away as few digital cameras as possible which spinner should they offer each customer to use? Justify your answer.

2. If a customer can select any spinner and he wants the best chance to win the digital camera, which spinner should he use? Justify your answer.

Spinner Creation - Transparency

3. Create a spinner for the electronics store to use so that they would never have to give away a digital camera. Justify your spinner.

4. Create a spinner that the customer could use so that he would win a digital camera every time. Justify your spinner.

5. Create a spinner so the customer's chance of winning a DVD is better than the chance of winning a video game. Justify your spinner.

6. Create a spinner so that the customer's chance of winning a CD is the same as not winning a CD. Justify your spinner.

Activity Master – Let's Match It

Let's Match It

Let's Match It

Let's Match It

Let's Match It

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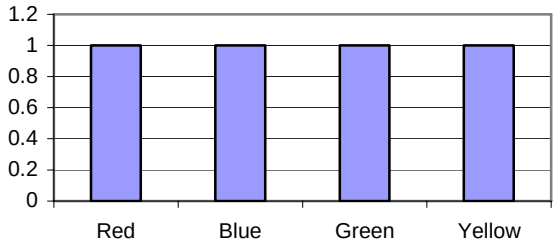
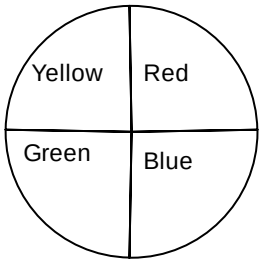
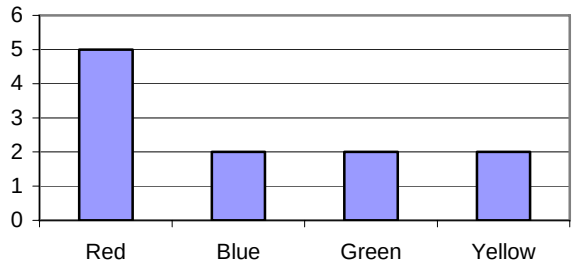
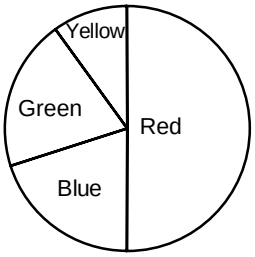
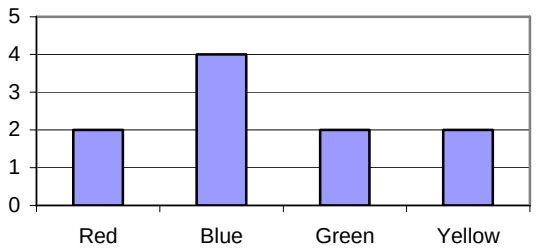
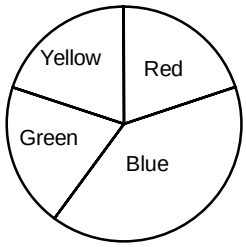
Activity Master – Let's Match It

	
The theoretical probability of drawing red is $\frac{1}{4}$.	The theoretical probability of NOT drawing green is $\frac{3}{4}$.
The theoretical probability of drawing yellow is $\frac{1}{4}$.	The theoretical probability of NOT drawing blue is $\frac{3}{4}$.
A bag contains four marbles: 1 red, 1 blue, 1 yellow, and 1 green marble.	

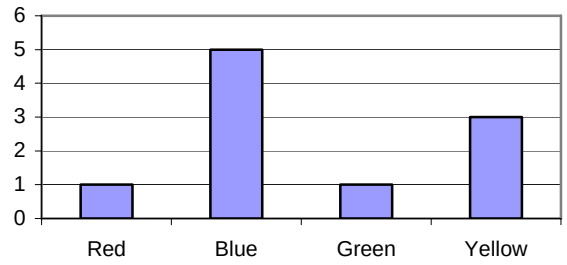
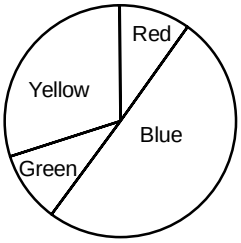
Activity Master – Let's Match It

	
The theoretical probability of NOT drawing red is $\frac{1}{2}$.	The theoretical probability of drawing blue is $\frac{1}{5}$.
The theoretical probability of drawing green is $\frac{1}{5}$.	The theoretical probability of NOT drawing yellow is $\frac{9}{10}$.
A bag contains 10 marbles: 5 red, 2 blue, 1 yellow, and 2 green marbles.	

Activity Master – Let's Match It

	
The theoretical probability of drawing red is $\frac{1}{5}$.	The theoretical probability of NOT drawing blue is $\frac{3}{5}$.
The theoretical probability of NOT drawing yellow is $\frac{4}{5}$.	The theoretical probability of drawing green is $\frac{1}{5}$.
A bag contains 10 marbles: 2 red, 4 blue, 2 yellow, and 2 green marbles.	

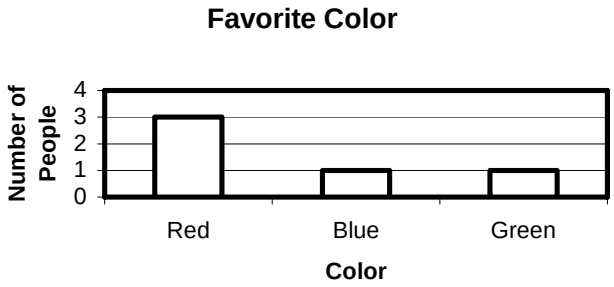
Activity Master – Let's Match It

	
The theoretical probability of NOT drawing yellow is $\frac{7}{10}$.	The theoretical probability of drawing green is $\frac{1}{10}$.
The theoretical probability of NOT drawing blue is $\frac{1}{2}$.	The theoretical probability of drawing red is $\frac{1}{10}$.
A bag contains 10 marbles: 1 red, 5 blue, 3 yellow, and 1 green marble.	

What Color?

Part I.

Mary conducted a survey to determine the favorite color of 5 students in her advisory class. The results are shown in the bar graph below.



She then took a color tile and let it represent the color of each student's vote and put it in a bag.

1. How many color tiles of each color should she put in the bag? Justify your answer.

2. If Mary draws a color tile at random out of the bag, how likely is she to draw a red tile? Why?

3. If Mary draws a color tile at random out of the bag, how likely is she to draw a blue tile? Why?

4. If Mary draws a color tile at random out of the bag, how likely is she to draw a green tile? Why?

5. Sketch a circle graph to represent what part of the whole each color tile represents in the Favorite Color data.

6. Transfer your sketch onto a piece of chart paper.

7. Record on the chart paper: What are the similarities and differences in the circle graph you drew and the bar graph you were given?

Part II.

Mary wanted to conduct an experiment using the bag of tiles she created based on the information in the Favorite Color graph. She decided she would draw a tile out of the bag, record the color of the tile, return the tile to the bag, and draw again. She decided to repeat this process for 25 draws.

1. How many of the 25 draws should Mary expect to be red? Why?

2. How many of the 25 draws should Mary expect to be blue? Why?

3. How many of the 25 draws should Mary expect to be green? Why?

The number of possible outcomes (how many tiles of a color) out of all possible outcomes (total number of tiles) is called the *Theoretical Probability*

Model the same experiment that Mary did using color tiles and a bag.

- **Create a frequency table like the one below on the chart paper**
- **Put a color tile for each student vote in the bag**
- **Draw a color tile at random from the bag**
- **Record the color of the tile on the chart paper and worksheet**
- **Return the tile to the bag**
- **Repeat this process 25 times**

Color	Tally	Frequency
Red		
Blue		
Green		

The number of tiles you actually draw from the bag in an experiment is called the *Experimental Probability*.

4. What was your experimental probability of drawing a red?, a blue?, a green?

5. How did the number of red tiles you drew compare to the number you said Mary should have drawn?

(Continue: What Color? – Part II.)

6. How did the number of blue tiles you drew compare to the number you said Mary should have drawn?

7. How did the number of green tiles you drew compare to the number you said Mary should have drawn?

8. How close was your prediction to the actual results?

9. What could you do to get your experimental probability to be closer to the theoretical probability?

10. Predict what would happen if you continued the experiment for 100 more draws.

11. Sketch a circle graph of the experimental data on the chart paper.

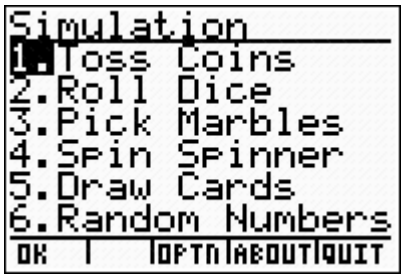
Part III.

Model Mary's experiment using the TI-73 calculator, and create a circle graph of the collected. Create a second frequency table like the one in Part I on the chart paper. Record the results on the chart paper and worksheet

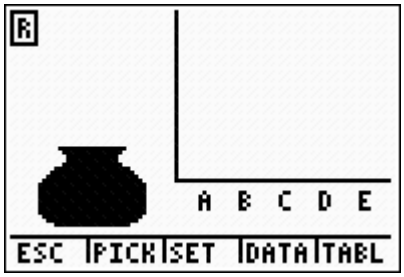
By using the TI-73 calculator to simulate the experiment a large data set can be collected in a very short amount of time.

A. [ON]→[APPS] → (Prob Sim)→[ENTER]

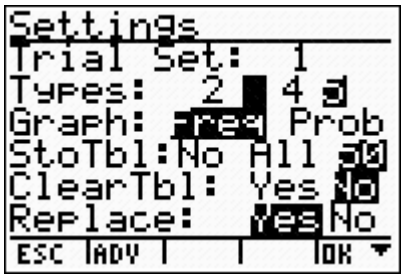
B. [3] *(Pick Marbles)*



C. [ZOOM] *(Set for settings)*



D. Under Settings, set up as illustrated.
   Trial Set: 1
   Types: 3
   Replace: Yes



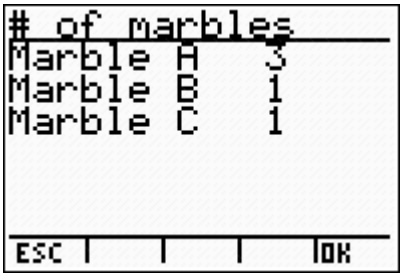
(Continue: What Color? – Part III.)

E. [WINDOW]
Under # of marbles, set up colors as illustrated.

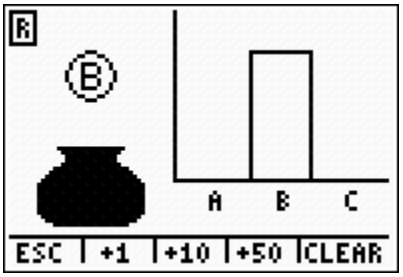
Red → Marble A: 3

Blue → Marble B: 1

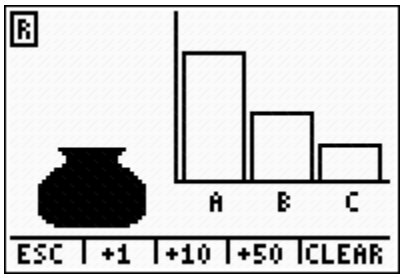
Green →Marble C: 1



F. [ENTER]



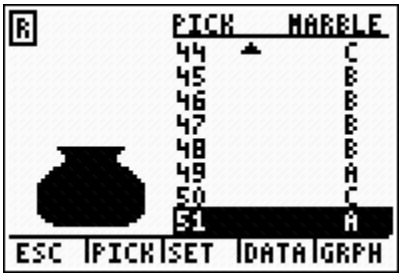
G. [TRACE]
(this will simulate 50 trials)



H. [GRAPH]
(this will show a table of the data generated)

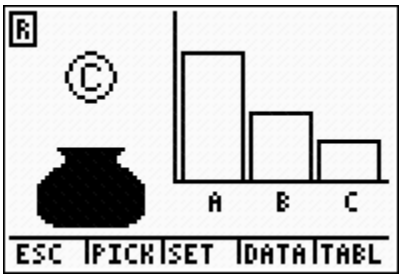
I. [TRACE]

Copy the data into the frequency table.



(Continue: What Color? – Part III.)

J. Sketch the graph on chart paper.



1. What was the experimental probability of drawing a red?, a blue?, a green?

2. Has the experimental probability moved closer to the theoretical probability? Justify your answer.

You Design It

Use a graphing calculator to design a spinner that has each of the theoretical probabilities listed in the table.

$P(\text{Red}) = \frac{1}{3}$
$P(\text{Blue}) = \frac{1}{4}$
$P(\text{Green}) = \frac{1}{4}$
$P(\text{Yellow}) = \frac{1}{6}$

Explain how you designed your spinner.

1 Alan has 3 peppermint candies, 8 cinnamon candies, 4 root beer candies, and 6 butterscotch candies in a bag. If he draws a piece of candy at random from the bag, what is the probability he will draw a piece of butterscotch candy?

A $\frac{5}{7}$

B $\frac{3}{5}$

C $\frac{2}{5}$

D $\frac{2}{7}$

2 Mary has a quarter to buy a gumball from a machine. In the machine there are 3 red gumballs, 4 blue gumballs, 3 yellow gumballs, and 2 green gumballs. What is the probability that Mary will NOT get a yellow gumball when she puts her quarter in the machine to buy a gumball?

A $\frac{3}{4}$

B $\frac{2}{3}$

C $\frac{1}{3}$

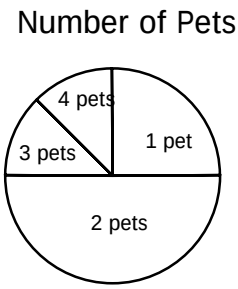
D $\frac{1}{4}$

3 Alicia conducted a survey about the number of pets people owned. The results of the survey are shown in the table below.

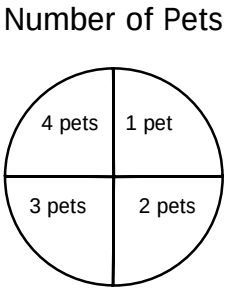
Number of Pets

Number of Pets	People
1	50
2	100
3	25
4	25

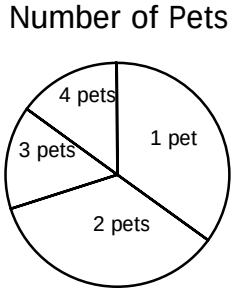
A

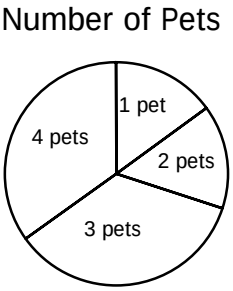


C

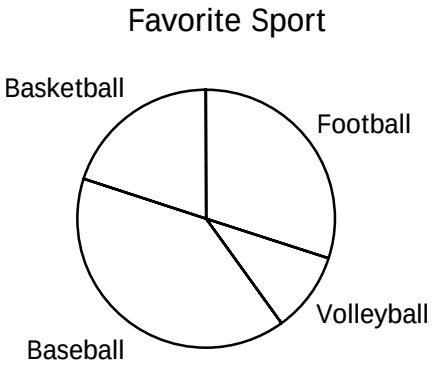


B





4 The circle graph shows the results of a survey about students' favorite sports. Which statement is supported by the information in the circle graph?



A Football is the most popular sport.

B More people said baseball was their favorite sport than basketball.

C Basketball is the least favorite sport.

D More people said basketball was their favorite sport than football.